

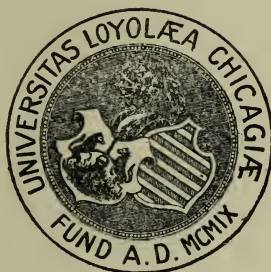
c
L95c2e
1916/17

LOYOLA UNIVERSITY

Department of Engineering

DEC 1 1920 UNIVERSITY OF CHICAGO LIBRARY

DEC 20 1920



Address: The Registrar or the Dean
Loyola Avenue and Sheridan Road, Chicago, Illinois
Telephone Rogers Park 620

OFFICERS AND FACULTY

JOHN B. FURAY, S. J., PRESIDENT OF THE UNIVERSITY.

HENRY S. SPALDING, S. J., Regent.

WILLIAM H. CAHILL, M. A., M. Sc., C. E., Dean.

PAUL M. BREEN, S. J., Treasurer.

EDWARD J. MORGAN, S. J., Professor of Analytical Chemistry.

GEORGE L. SECORD, Ph. D., Professor of Organic Chemistry.

PHILIP FROEBES, S. J., Professor of Physics.

LEO. P. STOESSER, B. Sc., Instructor in Mechanical Engineering.

WILLIAM H. CAHILL, A. M., M. Sc., C. E., Professor of Civil Engineering.

THOMAS A. KELLY, S. J., Professor of Mathematics.

JAMES FENELON WALSH, Professor of Commercial Art.

G. CAMPBELL-CHATTERTON, Assistant Professor of German.

JEREMIAH O'CALLAGHAN, S. J., Professor of English Literature.

EDWARD HELFERS, Assistant Professor of German.

JAMES F. WALSH, Professor of Drawing.

JOHN KOKENGE, S. J., Professor of German.

HERMAN RUTENBERG, Ph. D., Assistant Professor of Chemistry.

REQUIREMENTS FOR ADMISSION.

Candidates for admission to the College of Engineering must be at least sixteen years of age, must present satisfactory testimonial of good moral character, and must be qualified in fifteen units of entrance subjects as enumerated below.

NOTE.—A unit represents the equivalent of five prepared recitations a week for one scholastic year in a single subject.

The prescribed units are:

English	3 units
History	1 unit
Elementary Algebra	1 unit
Advanced Algebra	$\frac{1}{2}$ unit
Plane Geometry	1 unit
Solid Geometry	$\frac{1}{2}$ unit
Elementary Physics	1 unit
Total	<u>8 units</u>

Electives sufficient to make up the required fifteen units may be offered from the following list:

Latin	2 to 4 units
Greek	1 to 3 units
German	2 to 3 units
French	2 to 3 units
English	1 to 2 units
History	1 to 2 units
Higher Algebra	$\frac{1}{2}$ unit
Plane Trigonometry	$\frac{1}{2}$ unit
Elementary Chemistry	1 unit
Biological Science	1 to 2 units
Manual Training	2 units

Admission may be secured in one of the following ways:

1. BY EXAMINATION.—Entrance examinations will be held at the university in June and September. See Calendar.

2. BY CERTIFICATE.—Graduates from standard high schools or other approved preparatory schools will be admitted on presentation of official certificates exhibiting the number of merits to which the applicant is entitled in each subject of the preparatory course pursued.

3. FROM OTHER COLLEGES.—Students from other institutions, whose entrance requirements and courses are substantially equivalent to those of Loyola University, will, upon presenting proper certificates of good standing and honorable dismissal, be admitted to advanced standing without examination and be given credit for the work done in such institutions.

4. AS SPECIAL STUDENTS.—Persons over 19 years of age, not candidates for degrees, will be admitted as special students, provided they give evidence of preparation for the subjects desired. Such students may become candidates for degrees by passing the examinations prescribed for entrance.

FEES AND EXPENSES.

Matriculation fee	\$ 5.00
Tuition	100.00
Diploma fee	10.00
Engineering laboratories, per credit, per semester..	2.50
Physical and chemical laboratories, per credit, per semester	2.50
Surveying, field work, per semester.....	3.00
Summer course in surveying, 2 weeks.....	12.50
Summer course in surveying, 4 weeks.....	25.00
Breakage deposit (Chemistry)	10.00

The matriculation fee is paid only once. The tuition fee is payable in two installments: \$50.00 on October 1st and \$50.00 on February 1st; ten days of grace are allowed. At the end of that time non-payment debars from classes.

No rebate is allowed on tuition paid, but when a student is forced, for valid reasons, to withdraw from college, the balance of the tuition representing that part of the semester for which he is absent may be redeemed in any other department studies within one year from date of withdrawal from the college.

Any balance remaining at the end of each year from the deposit required to defray the expense of breakage in the chemical laboratories will be refunded or credited for the succeeding year at the option of the student.

The college provides no dormitory system for students. Board and rooms may be obtained in the vicinity of the college at reasonable rates.

Further information may be obtained from the Registrar or the Dean of the College of Engineering.

LENGTH OF COURSE

For the present Loyola is offering two years of work in the engineering department. The course in these two years is thorough and is arranged to harmonize with the larger engineering schools of the country so that students may pass to other schools to complete the work without inconvenience or loss of time.

An engineering course naturally divides itself into two distinct periods of two years each, the first two years being devoted largely to theoretical work, and the last two to practical questions. With small classes Loyola is prepared to give a better course for Freshman and Sophomore years than can be given in many large universities where the number of students is so large that anything like personal attention is impossible. The deans of larger schools are encouraging the Junior colleges (that is colleges in which the first two years are complete), as they find it impossible to care for the hundreds of young men who enter upon engineering courses.

A course parallel with the Freshman and Sophomore years as given at the University of Illinois has been arranged for with the State University authorities. Students completing such a course at Loyola will be admitted to full Junior standing at the University of Illinois.

The department of engineering is now entering upon its fifth year. Students who have done the first two years at Loyola and who have completed their work at other schools have assured that faculty that their course at Loyola prepared them well for advanced work. The school then has passed beyond the experimental period and can assure its students entire satisfaction in the Freshman and Sophomore years.

COURSES OF STUDY

The outlines of the courses which follow, and the formulation of their requirements, rest on the well founded theory that successful endeavor in any field of engineering activity depends primarily on thorough theoretical and practical training in the fundamental sciences on which modern engineering practice is based. To give such training as may lead to future usefulness on the part of its students, and to develop in them the power to attack and solve new engineering and scientific problems, is the purpose of the instruction offered in the College of Engineering. The work, therefore, in all the courses outlined, is mostly prescribed, and, because of the correlation and interdependence of the professions for which training is provided, a large proportion of the studies—modified in form and extent to meet the general requirements of the individual courses—are taken in common by all students.

Contemporary engineering practice has assumed many phases of specialization within the rather comprehensive fields of civil, mechanical, electrical, and chemical engineering in the general acceptance of the terms. No one may hope to become expert in more than a very few of the various lines classified under one or another of these broad divisions. Though specialized practice is the order of the day, it is very generally recognized that extreme latitude in the election of special technical studies, in connection with the courses offered, is not conducive to sound engineering education, and tends to defeat the real purpose of engineering training. There are therefore included as elective only a comparatively small number of such special technical subjects as are admittedly valuable in affording desirable general scientific training and promoting immediate average efficiency along broad lines of professional activity.

Frequent visits of inspection, according to prearranged schedule under the guidance of instructors, will be made to convenient manufacturing and industrial establishments, power plants, public works, the sites of important pieces of construction, and other

points affording opportunities for stimulating the student's interest and increasing his knowledge. Such visits, besides familiarizing him in a general way with the significance of productive and constructive engineering and lending themselves to his acquirement of exact habits of observation, will afford a basis for written work in which rhetorical and technical instruction may be advantageously combined.

In line with the foregoing, the work in all the courses is identical during the first year, and there is little divergence during the second year. The student is thus afforded an opportunity for self-adjustment, and the danger of premature choice of profession, which is a factor to be reckoned with, is decreased; but he will have become habituated to the scientific methods of thought and procedure so important in the prosecution of his further studies.

OUTLINE OF COURSES

FRESHMEN YEAR—COMMON TO ALL COURSES.

	First Semester.	Second Semester.
English	3	3
Logic	2	0
German or French.....	4	4
Chemistry	3	3
Drawing and Descriptive Geometry.....	3	3
Advanced Algebra	3	0
Trigonometry	3	0
Analytical Geometry	0	5
Elementary Surveying	0	3
	21	21
Surveying	2 weeks	
Shop work	8 weeks	

CIVIL ENGINEERING

SOPHOMORE YEAR.

Physics	5	5
Calculus	5	3
Differential Equations	0	2
Analytical Chemistry	3	0
Drawing	3	2
Geology	3	0
Economics	2	0
Advanced Surveying	0	4
Technical Mechanics	0	5
	21	21
Topographic Surveying	4 weeks	
Shop or field work.....	6 weeks	

MECHANICAL AND ELECTRICAL ENGINEERING

SOPHOMORE YEAR.

Physics	5	5
Calculus	5	3
Differential Equations	0	2
Analytical Chemistry	3	0
Machine Drawing	3	0
Geology	3	0
Economics	2	0
Kinematics	0	6
Technical Mechanics	0	5
	21	21
Shop work.....	10 weeks	

CHEMICAL ENGINEERING

SOPHOMORE YEAR.

Physics	5	5
Calculus	5	3
Differential Equations	0	2
Quantitative Chemistry.....	3	3
Drawing	3	0
Geology	3	0
Economics	2	0
Kinematics	0	3
Technical Mechanics	0	5
	21	21
Shop work.....	10 weeks	

DESCRIPTION OF COURSES

ENGLISH.

The object of the instruction is to enable the student to express himself clearly, concisely, accurately, and vigorously, special stress being laid on those parts of rhetoric which will be of greatest value to engineering students. The written exercises are designed to accord with the other work of the courses. Students are instructed in the use of the library collections.

1. A course in rhetorical theory and practice, with essays based on the lives of distinguished scientists and visits of inspection.

Freshman; 1st semester; 3 credits.

2. A continuation of course 1, with essays based on assigned technical readings and visits of inspection.

Freshman; 2nd semester; 3 credits.

3. A conditional course supplementing the work of 1 and 2, and consisting wholly of theme work and consultation.

Required only of students who show inability to write clear and correct English. It will be continued until a satisfactory degree of proficiency is attained.

FRENCH AND GERMAN.

All students are required to take one year of work in either French or German. Elementary and advanced courses will be offered in each and the student may elect either. For outlines and descriptions of these courses see Bulletin of the College of Arts and Sciences.

MATHEMATICS.

1. **ADVANCED ALGEBRA.**—A brief review of the foundations with graphic representation and of the theory and use of logarithms, followed by a treatment of permutations and combinations, theory of limits, series, undetermined coefficients, determinants, theory of equations, complex numbers.

Freshman; 1st semester; 3 credits.

2. **TRIGONOMETRY.**—The trigonometric functions and their relations; proofs of the principal formulas of plane trigonometry; proofs of formulas and solution of all cases of right and oblique plane triangles; computation of areas.

Proofs of principal formulas of spherical trigonometry; formulas and solutions for right and oblique spherical triangles.

Freshman; 1st semester; 3 credits.

Numerous dependent problems and applications.

3. ANALYTIC GEOMETRY.—Graphic representation; the straight line; conic sections; higher plane curves; the essentials of Solid Analytic Geometry. Considerable problem work is required.

Freshman; 2nd semester; 5 credits.

4. DIFFERENTIAL AND INTEGRAL CALCULUS.—The direct and inverse operations are carried on in parallel. The fundamental formulas and methods of differentiating and integrating are followed by a geometric treatment of maxima and minima; applications to curves, surfaces, and volumes are considered. Taylor's Theorem and the subject of series in general will be treated in the second semester, together with the applications of the calculus to the engineering sciences. Some attention will be given to the subjects of Hyperbolic and Elliptic functions. Considerable problem work is exacted.

Sophomore; 1st semester, 5 credits; 2nd semester, 3 credits.

5. DIFFERENTIAL EQUATIONS.—The purpose of the course, which is supplementary to course 4, is to familiarize the student with the types of equations ordinarily encountered in the study of the engineering sciences, and to indicate the principles and methods employed in their solution. The solution of numerous problems will be made a leading feature of this course.

Sophomore; 2nd semester, on completion of course 4; 2 credits.

GEOLOGY.

1. GENERAL GEOLOGY.—A presentation of the general principles of geology and their practical applications. The course will be arranged with special reference to the needs of engineering students. Occasional excursions will replace laboratory practice. Three lectures and one laboratory period per week.

Sophomore; 1st semester; 3 credits.

ECONOMICS.

1. ELEMENTS OF ECONOMICS.—A general survey of economic theory and a discussion of present-day economic problems including wages, rent, interest, currency, banking, taxation, tariff, trusts, trades-unionism, socialism. Lectures and classroom discussions.

Sophomore; 2nd semester; 2 credits.

PHILOSOPHY.

1. LOGIC.—Formal logic or dialectics; definition, material and formal elements, kinds of reasoning, how to build an argument, analytic and synthetic methods. Material logic: truth, its nature and kinds, certitude, skepticism, cognoscitive faculties, authority, etc.

Freshman; 1st semester; 2 credits.

2. **PSYCHOLOGY AND ETHICS.**—Nature and properties of the human soul, cognoscitive faculties, intellect, will, liberty. General ethics, human action, morality, form of human action, divine and human laws. Applied ethics, rights and duties, right of property, socialism, society, law, etc.

PHYSICS.

1. **GENERAL PHYSICS.**—A general course in the subjects of Mechanics and Heat; Light and Sound; Electricity and Magnetism. The methods of the calculus are employed to a considerable degree. Two lecture-demonstrations, two recitations, and two laboratory periods per week.

Sophomore; throughout the year; 5 credits per semester.

2. **PHYSICAL MEASUREMENTS.**—A laboratory course, supplemented by twelve lectures on the theory and methods of precise thermal and electrical measurements, involving quantitative work in the use of various instruments of precision, and the determination of physical constants. A report of specified form is required on each experiment.

Elective; throughout the year; 2 credits per semester.

3. **PRACTICAL PHOTOGRAPHY.**—The principles and processes of dry plate photography, including lectures on photographic optics and laboratory work in the exposure and development of dry plates; printing processes, copying, enlarging, and the making of lantern slides.

Elective; second semester; 2 credits.

DRAWING AND DESCRIPTIVE GEOMETRY.

NOTE.—The freshman work in drawing and descriptive geometry is given as a combined course, but, in the cases of special students or of those admitted to advanced standing, separate courses may be given as follows:

1. **ELEMENTS OF DRAWING.**—Freehand lettering; sketching and dimensioning; geometrical construction; orthographic projection and isometric drawing; working drawings, including conventions, standards, etc.; tracing and reproductive processes. Notes and lectures on drafting room methods.

Freshmen; 1st semester; 3 credits.

2. **DESCRIPTIVE GEOMETRY.**—The descriptive geometry of points, lines, planes, surfaces, and solids. Tangencies, intersections, and developments. Shades and shadows and the principles of linear perspective. One lecture or recitation and two drafting periods a week.

Freshmen; 2nd semester; 3 credits.

MECHANICS AND HYDRAULICS.

1. **TECHNICAL MECHANICS.**—The principles of Statics, Kinematics, and Kinetics, with technical applications. Analytic and graphic methods are used concurrently in the solution of problems.

Sophomore; 2nd semester; 5 credits.

2. **RESISTANCE OF MATERIALS.**—A study of the more important materials of construction, their manufacture, properties, and structural uses, and the theory of resistance to stress and deformation with applications to engineering design. Lectures and recitations.

Elective; 1st semester; 5 credits.

CIVIL ENGINEERING.

1. **ELEMENTARY SURVEYING.**—Lectures, recitations, field and office work covering the principles, uses, and adjustments of the engineer's level and transit, and the uses of the steel tape; topographic surveying with transit and stadia.

Freshmen; 2nd semester; 3 credits.

2. **ADVANCED SURVEYING.**—The application of the fundamental operations to city, land, mine, and hydrographic surveying; the use of the plane table and sextant; precise leveling and triangulation; including the measurement of base lines and angles; the determination of azimuth by solar observation. Lectures, recitations, field and office work.

Sophomore; 2nd semester; 4 credits.

3. **SUMMER SURVEYING.**—The Summer courses in surveying are given at the close of the school year in June and are of a practical nature. The student will spend ten hours a day in the field or office in the performance of the various duties incident to the work of the surveyor. The courses in Elementary and Topographic Surveying are prescribed. The course in Railway Surveying and Location is optional. The periods allotted to these courses are two weeks for Elementary Surveying, and four weeks each for Topographic and Railway Surveying.

4. **TOPOGRAPHIC DRAWING.**—The conventional methods of representing topography and the platting of the results of surveys.

Sophomore; 2nd semester; 2 credits.

5. **CONSTRUCTION DRAWING.**—Stereotomy, dams, piers, arches, trestles, culverts, etc. Applications of Descriptive Geometry to engineering construction.

Sophomore; 1st semester; 3 credits.

6. **RAILWAY ENGINEERING.**—Lectures, recitations, field, and office work dealing with the subjects of railway location and construction. The theory of simple, compound, and transition curves, cross-overs, frogs and switches, turnouts, etc. Cross sectioning, the computation of cut, fill and haul; road bed construction, including ballast, track, culverts, trestles, etc. Estimates and costs.

MECHANICAL ENGINEERING.

1. **MACHINE DRAWING.**—A continuation of Drawings 1 and 2, and the application of their principles to machine drawing and empirical design. Sketching and detailing machine elements from model and copy; the making and use of standard data sheets; detail assembly drawings of complete machines. The work is designed to familiarize the student with commercial drafting room practice, and is of distinctly vocational character.

Sophomore; 1st semester; 3 credits.

2. **KINEMATICS OF MACHINERY.**—Lectures and recitations on the theory of mechanisms, instant centers, cams, gears, linkage, velocity and acceleration diagrams, etc.

Sophomore; 2nd semester; 3 credits.

3. **KINEMATIC DRAWING.**—The graphic application of the principles of course 2. A series of separate problems of graded complexity will be assigned to each student.

Sophomore; 2nd semester; 3 credits.

3a. **KINEMATICS.**—A combined lecture, recitation, and drafting room course briefer than 2 and 3, and arranged to satisfy the requirement in the principles of mechanism for chemical engineering students.

Sophomore; 2nd semester; 3 credits.

CHEMISTRY AND CHEMICAL ENGINEERING.

1. **GENERAL CHEMISTRY.**—Entrance Chemistry, if offered, will not be accepted as the equivalent of this course.

Two lecture-demonstrations, one recitation, and one laboratory period, covering the fundamental principles of the science, the chemistry of the non-metals, and metals and the elements of qualitative chemical analysis.

Freshmen; throughout the year; 3 credits.

2. **QUALITATIVE ANALYSIS.**—The laboratory work will be varied to some extent according to the course pursued and will include analyses of alloys, rocks, minerals, slags, mattes, and other compounds or mixtures. One lecture or recitation and three laboratory periods per week.

Sophomore; 2nd semester; 3 credits.

3. **QUANTITATIVE ANALYSIS.**—An introductory course consisting of one lecture and three laboratory periods per week devoted to volumetric and gravimetric determinations, including practice in the calibration of flasks and burettes, acidimetry and alkalimetry, chlorimetry, and the analysis of simple compounds and ores.

Sophomore; 2nd semester; 3 credits.

4. **ORGANIC CHEMISTRY.**—Two lectures and one recitation on the general principles and theories of organic chemistry and the methods of preparation and characteristic reactions of organic compounds with a correspond-

ing laboratory course of three periods per week. A limited amount of work along special lines or organic chemistry may be elected.

Sophomore; throughout the year; 5 credits.

EXAMINATIONS

Examinations are held semi-annually at the end of each semester. The work done during the semester, as well as the examinations, is considered in the grading of students. The results of the examinations are expressed on the basis of 100.

70 is required for passing; 60-70 indicates a condition; below 60 shows failure. Regularity of attendance at lectures and laboratory, and faithfulness in the performance of daily work are of as much weight in determining the standing of students in their classes as are the examinations.

Conditions.—Conditioned students must remove such conditions at the examinations given for that purpose during the following semester. Failing in this the student is obliged to discontinue the subject in which he is conditioned and to repeat it during the next semester.

For a special examination of this kind a fee of \$1.00 is charged.

Printed by
Loyola University Press
Chicago
1916

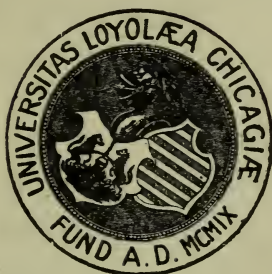
c
L95c7e
1917/18

LOYOLA UNIVERSITY

Department of Engineering

CHICAGO, ILLINOIS

1917 — 1918



UNIVERSITY OF ILLINOIS LIBRARY

OCT 21 1918

Address: The Registrar or the Dean
Loyola Avenue and Sheridan Road, Chicago, Illinois
Telephone Rogers Park 620

Calendar

1917

September 18-19	Registration
September 20.....	First Semester begins
November 29.....	Thanksgiving Recess
December 2.....	Classes resumed
December 24.....	Christmas Recess

1918

January 3.....	Classes resumed
January 24-31	Semester Examinations
February 1.....	Second Semester begins
February 12.....	Lincoln's Birthday, a holiday
February 22.....	Washington's Birthday, a holiday
March 28.....	Easter Recess
April 3.....	Classes resumed
May 31.....	Second Semester ends
June 1-15	Summer Surveying

Officers and Faculty

- JOHN B. FURAY, S.J.
President of the University.
- GEORGE J. LEAHEY, S.J.
Vice-President.
- PHILIP W. FROEBES, S.J.
Regent, Professor of Physics.
- JAMES J. DONEGAN, Ph.B.
Dean and Professor of Engineering.
- PAUL M. BREEN, S.J.
Treasurer.
- EDWARD J. MORGAN, S.J.
Professor of Chemistry
- CHARLES P. MILLER, S.J.
Professor of Mathematics.
- CHARLES E. SCHUETZ, S.J.
Professor of English.
- JEREMIAH J. O'CALLAGHAN, S.J.
Professor of Logic.
- BENJAMIN H. ROUSE, Ph.B.
Professor of Biology.
- HERMAN RUTENBERG, Ph.D.
Assistant Professor of Chemistry.
- EDGAR N. DREW, B.S.
Instructor in Shop and Drawing.
- JAMES FITZGERALD, M.A.
Instructor in Political Economy.
- JAMES F. WALSH
Instructor in Commercial Art.
- CHARLES N. LISCHKA
Instructor in German.

Requirements for Admission

Candidates for admission to the College of Engineering must be at least sixteen years of age, must present satisfactory testimonial of good moral character, and must be qualified in fifteen units of entrance subjects as enumerated below.

Note.—A unit represents the equivalent of five prepared recitations a week for one scholastic year in a single subject.

The prescribed units are:

English (composition and literature).....	3 units
Elementary Algebra	1 unit
Advanced Algebra	$\frac{1}{2}$ unit
Plane Geometry	1 unit
Solid Geometry	$\frac{1}{2}$ unit
Physics, or Chemistry, or Botany, or Zool- ogy, or Physiology, with Laboratory work	1 unit

Total 7 units

Electives sufficient to make up the required fifteen units may be offered from the following list:

	Units
Latin	1—4
Greek	1—3
French	1—4
German	1—4
Spanish	1—4
English (4th unit).....	1
Trigonometry	$\frac{1}{2}$

History	1—3
Civics	$\frac{1}{2}$ —1
Economics and Economic History.....	$\frac{1}{2}$ —1
Commercial Geography	$\frac{1}{2}$ —1
Physiology	$\frac{1}{2}$ —1
Zoology	$\frac{1}{2}$ —1
Botany	$\frac{1}{2}$ —1
Physics	1—2
Chemistry	1—2
Bookkeeping	1
Business Law	$\frac{1}{2}$
Drawing, Art and Design	$\frac{1}{2}$ —1
Drawing, Mechanical	$\frac{1}{2}$ —1
Manual Training	1—2
Music	1—2

Admission may be secured in one of the following ways:

1. **By Examination.** Entrance examinations will be held at the University in June and September. See Calendar.

2. **By Certificate.** Graduates from standard high schools or other approved preparatory schools will be admitted on presentation of official certificates exhibiting the number of merits to which the applicant is entitled in each subject of the preparatory course pursued.

3. **From Other Colleges.** Students from other institutions, whose entrance requirements and courses are substantially equivalent to those of Loyola University, will, upon presenting proper certificates of good standing and honorable dismissal, be admitted to advanced standing without examination and be given credit for the work done in such institutions.

4. **As Special Students.** Persons over 19 years of age, not candidates for degrees, will be admitted as special students, provided they give evidence of preparation for the subjects desired. Such students may become candidates for degrees by passing the examinations prescribed for entrance.

FEES AND EXPENSES

Matriculation fee	\$ 5.00
Tuition	100.00
Engineering Laboratories, per semester....	3.00
Physical and chemical laboratories, per semester	3.00
Surveying, field work, per semester.....	3.00
Summer course in surveying, 2 weeks.....	3.00
Breakage deposit (Chemistry).....	10.00

The matriculation fee is paid only once. The tuition fee is payable in two installments: \$50.00 on October 1st and \$50.00 on February 1st; ten days of grace are allowed. At the end of that time non-payment debars from classes.

No rebate is allowed on tuition paid, but when a student is forced, for valid reasons, to withdraw from college, the balance of the tuition representing that part of the semester for which he is absent may be redeemed in any other department studies within one year from date of withdrawal from the college.

Any balance remaining at the end of each year from the deposit required to defray the expense of breakage in the chemical laboratories will be refunded or credited for the succeeding year at the option of the student.

The college provides no dormitory system for students. Board and rooms may be obtained in the vicinity of the college at reasonable rates.

Further information may be obtained from the Registrar or the Dean of the College of Engineering.

Length of Course

For the present Loyola is offering two years of work in the engineering department. The course in these two years is thorough and is arranged to harmonize with the larger engineering schools of the country so that students may pass to other schools to complete the work without inconvenience or loss of time.

An engineering course naturally divides itself into two distinct periods of two years each, the first two years being devoted largely to theoretical work, and the last two to practical questions. With small classes Loyola is prepared to give a better course for Freshman and Sophomore years than can be given in many large universities where the number of students is so large that anything like personal attention is impossible. The deans of larger schools are encouraging the Junior colleges (that is colleges in which the first two years are completed), as they find it impossible to care for the hundreds of young men who enter upon engineering courses.

A course parallel with the Freshman and Sophomore years as given at the University of Illinois has been arranged for with the State University authorities. Students completing such a course at Loyola will be admitted to full Junior standing at the University of Illinois.

The department of engineering is now entering upon its sixth year. Students who have done the first two years at Loyola and who have completed their work at other schools have assured that faculty that their course at Loyola prepared them well for advanced work. The school then has passed beyond the experimental period and can assure its students entire satisfaction in the Freshman and Sophomore years.

Courses of Study

The outlines of the courses which follow, and the formulation of their requirements, rest on the well founded theory that successful endeavor in any field of engineering activity depends primarily on thorough theoretical and practical training in the fundamental sciences on which modern engineering practice is based. To give such training as may lead to future usefulness on the part of its students, and to develop in them the power to attack and solve new engineering and scientific problems, is the purpose of the instruction offered in the College of Engineering. The work, therefore, in all the courses outlined, is mostly prescribed, and, because of the correlation and interdependence of the professions for which training is provided, a large proportion of the studies—modified in form and extent to meet the general requirements of the individual courses—are taken in common by all students.

Contemporary engineering practice has assumed many phases of specialization within the rather comprehensive fields of civil, mechanical, electrical, and chemical engineering in the general acceptance of the terms. No one may hope to become expert in more than a very few of the various lines classified under one or another of these broad divisions. Though specialized practice is the order of the day, it is very generally recognized that extreme latitude in the election of special technical studies, in connection with the courses offered, is not conducive to sound engineering education, and tends to defeat the real purpose of engineering training. There are therefore included as elective only a comparatively small number of such special technical subjects as are admittedly valuable in affording desirable general scientific training and promoting immediate average efficiency along broad lines of professional activity.

Frequent visits of inspection, according to prearranged schedule under the guidance of instructors, will be made to convenient manufacturing and industrial establishments, power plants, public works, the sites of important pieces of construction, and other points affording opportunities for stimulating the student's interest and increasing his knowledge. Such visits, besides familiarizing him in a general way with the significance of productive and constructive engineering and lending themselves to his acquirement of exact habits of observation, will afford a basis for written work in which rhetorical and technical instruction may be advantageously combined.

In line with the foregoing, the work in all the courses is identical during the first year, and there is little divergence during the second year. The student is thus afforded an opportunity for self-adjustment, and the danger of premature choice of profession, which is a factor to be reckoned with, is decreased; but he will have become habituated to the scientific methods of thought and procedure so important in the prosecution of his further studies.

Outline of Courses

Freshman Year—Common to All Courses

	First Semester.	Second Semester.
English	3	3
Logic	2	0
Chemistry	4	4
Drawing	4	0
Descriptive Geometry	0	4
Algebra	3	0
Trigonometry	3	0
Analytic Geometry	0	5
Elementary Surveying	0	3
	19	19

Surveying at Summer Camp at Lake Beulah..2 weeks

CIVIL ENGINEERING

Sophomore Year

	First Semester.	Second Semester.
Physics	5	5
Calculus	5	3
Geology	3	0
Language	4	4
Economics	0	2
Mechanics	0	3
Advanced Surveying	0	3
	17	17

Surveying at Summer Camp at Lake Beulah..2 weeks

MECHANICAL AND ELECTRICAL ENGINEERING

Sophomore Year

	First Semester.	Second Semester.
Physics	5	5
Calculus	5	3
Geology	3	0
Economics	0	2
Language	4	4
Mechanics	0	3
Pattern Making, Forge, Foundry..	3	3
	—	—
	20	20

CHEMICAL ENGINEERING

Sophomore Year

	First Semester.	Second Semester.
Physics	5	5
Calculus	5	3
Geology	3	0
Economics	0	2
Language	4	4
Chemistry	3	3
Mechanics	0	3
	—	—
	20	20

Description of Courses

ENGLISH

The object of the instruction is to enable the student to express himself clearly, concisely, accurately, and vigorously, special stress being laid on those parts of rhetoric which will be of greatest value to engineering students. The written exercises are designed to accord with the other work of the courses. Students are instructed in the use of the library collections.

1. A course in rhetorical theory and practice, with essays based on the lives of distinguished scientists and visits of inspection.

Freshman; 1st semester; 3 credits.

2. A continuation of course 1, with essays based on assigned technical readings and visits of inspection.

Freshman; 2nd semester; 3 credits.

3. A conditional course supplementing the work of 1 and 2, and consisting wholly of theme work and consultation.

Required only of students who show inability to write clear and correct English. It will be continued until a satisfactory degree of proficiency is attained.

FRENCH AND GERMAN

All students are required to take one year of work in either French or German. Elementary and advanced courses will be offered in each and the student may elect either. For outlines and descriptions of these courses see Bulletin of the College of Arts and Sciences.

MATHEMATICS

1. **Advanced Algebra.** A brief review of the foundations with graphic representation and of the theory and use of logarithms, followed by a treatment of permutations and combinations, theory of

limits, series, undetermined coefficients, determinants, theory of equations, complex numbers.

Freshman; 1st semester; 3 credits.

2. **Trigonometry.** The trigonometric functions and their relations; proofs of the principal formulas of plane trigonometry; proofs of formulas and solution of all cases of right and oblique plane triangles; computation of areas.

Proofs of principal formulas of spherical trigonometry; formulas and solutions for right and oblique spherical triangles.

Freshman; 1st semester; 3 credits.

Numerous dependent problems and applications.

3. **Analytic Geometry.** Graphic representation; the straight line; conic sections; higher plane curves; the essentials of Solid Analytic Geometry. Considerable problem work is required.

Freshman; 2nd semester; 5 credits.

4. **Differential and Integral Calculus.** The direct and inverse operations are carried on in parallel. The fundamental formulas and methods of differentiating and integrating are followed by a geometric treatment of maxima and minima; applications to curves, surfaces, and volumes are considered. Taylor's Theorem and the subject of series in general will be treated in the second semester, together with the applications of the calculus to the engineering sciences. Considerable problem work is exacted.

Sophomore; 1st semester, 5 credits; 2nd semester, 3 credits.

5. **Differential Equations.** The purpose of the course, which is supplementary to course 4, is to familiarize the student with the types of equations ordinarily encountered in the study of the engineering sciences, and to indicate the principles and methods employed in their solution. The solution of numerous problems will be made a leading feature of this course.

Sophomore; 2nd semester, on completion of course 4; 2 credits.

GEOLOGY

1. **General Geology.** A presentation of the general principles of geology and their practical applications. The course will be arranged with special reference to the needs of engineering students. Occasional excursions will replace laboratory practice. Three lectures and one laboratory period per week.

Sophomore; 1st semester; 3 credits.

ECONOMICS

1. **Elements of Economics.** A general survey of economic theory and a discussion of present-day economic problems, including wages, rent, interest, currency, banking, taxation, tariff, trusts, trades-unionism, socialism. Lectures and classroom discussions.

Sophomore; 2nd semester; 2 credits.

PHILOSOPHY

1. **Logic.** Formal logic or dialectics; definition, material and formal elements, kinds of reasoning, how to build an argument, analytic and synthetic methods. Material logic: truth, its nature and kinds, certitude, skepticism, cognoscitive faculties, authority, etc.

Freshman; 1st semester; 2 credits.

2. **Psychology and Ethics.** Nature and properties of the human soul, cognoscitive faculties, intellect, will, liberty. General ethics, human action, morality, form of human action, divine and human laws. Applied ethics, rights and duties, right of property, socialism, society, law, etc.

PHYSICS

1. **General Physics.** A general course in the subjects of Mechanics and Heat; Light and Sound; Electricity and Magnetism. The methods of the calculus are employed to a considerable degree. Two lecture-demonstrations, two recitations, and two laboratory periods per week.

Sophomore; throughout the year; 5 credits per semester.

2. **Physical Measurements.** A laboratory course, supplemented by twelve lectures on the theory and methods of precise thermal and electrical measurements, involving quantitative work in the use of various instruments of precision, and the determination of physical constants. A report of specified form is required on each experiment.

Elective; throughout the year; 2 credits per semester.

3. **Practical Photography.** The principles and processes of dry plate photography, including lectures on photographic optics and laboratory work in the exposure and development of dry plates; printing processes, copying, enlarging and the making of lantern slides.

Elective; second semester; 2 credits.

DRAWING AND DESCRIPTIVE GEOMETRY

1. **Elements of Drawing.** Freehand lettering; sketching and dimensioning; geometrical construction; orthographic projection; isometric and oblique drawing; working drawings, including conventions, standards, etc., tracing and productive processes.

Freshmen; 1st semester; 4 credits.

2. **Descriptive Drawing.** The descriptive geometry of points, lines, planes, surfaces, and solids. Intersections and developments. Practical problems. One lecture or recitation and three drafting periods a week.

Freshmen; 2nd semester; 4 credits.

TECHNICAL MECHANICS

Fundamental principles; equilibrium, friction, center of gravity, motion; Application to engineering problems. Considerable problem work is required.

Sophomore; 2nd semester; 3 credits.

CIVIL ENGINEERING

1. **Plane Surveying.** Lectures, recitations, field and office work, general theory of plane surveying, use and adjustment of instruments, computations of areas, methods of U. S. system of public land surveying, city surveying, stadia.

Breed and Hosmer, *Principles and Practice of Surveying*, Vol. I. Davis, *Manual of Surveying*.

Freshmen; 2nd semester; 3 credits.

2. **Advanced Surveying.** Lectures, recitations and outside reading on triangulation, astronomical observations, precise leveling and topographical surveying.

Breed and Hosmer, *Higher Surveying*.

Sophomore; 2nd semester; 3 credits.

3. **Summer Surveying.** The engineering camp of Loyola University is located at Lake Beulah, Wisconsin. It is three miles from Mukwanago station on the Soo Line and may be reached directly over that road from Chicago or over the Milwaukee, St. Paul Railway to Milwaukee and then changing to the Milwaukee-Troy Center Electric Railway, which passes within 10 minutes' walk from the camp. Board, room and other expenses require a payment of \$15.00. The course is taken in conjunction with the Freshmen and Junior C. E. of Marquette University. The work consists of the practical application of the principles given in the

Freshman course of Elementary Surveying and the Sophomore course in advanced Surveying. The field practice is required of all Freshmen and Sophomore C. E. The course is given during the first two weeks in June.

4. **Railway Engineering.** Lectures, recitations, field, and office work dealing with the subjects of railway location and construction. The theory of simple, compound, and transition curves, cross-overs, frogs and switches, turnouts, etc. Cross sectioning, the computation of cut, fill and haul; road bed construction, including ballast, track, culverts, trestles, etc. Estimates and costs.

MECHANICAL ENGINEERING

1. **Machine Drawing.** A continuation of Drawing Courses I and II and the application of their principles to machine drawing and design. Sketching and detailing machine elements from model and copy; the making and use of standard data sheets; detail assembly drawings of complete machines. The work is designed to familiarize the student with commercial drafting room practice.

Sophomore; 1st semester; 3 credits.

2. **Pattern Making.** Instructions are given in hand work and the use and care of machines. The students are required to construct patterns for parts of machines from working drawings. Emphasis is placed upon the construction of gasoline engine patterns and core boxes, involving strength, warping and distortion, shrinkage, draft, finish, etc. The equipment consists of lathes, benches, circular and band saws, planes, trimmers etc.

3 credits.

3. **Forging.** In the forge shop, iron and steel are treated. Carbon and high speed steels are studied in gas and cyanite furnaces. Case and carbonizing, tempering and forging of blacksmiths' tools and parts of machines are forged, such as gas engine connecting rods, crank shafts, valves, special bolts, etc.

1 credit.

4. **Foundry.** The course includes bench, floor, and machine moulding, two and three part pattern moulding, all branches of core making, operation and care of cupolas and furnaces, casting of gray iron and semi-steel, brass and alloys.

In Courses II, III and IV, text-books are used and current articles read and written up by the students. Lectures are given on scientific shop management, principles of organization, efficiency, selection and compensation of labor, etc.

2 credits.

CHEMISTRY AND CHEMICAL ENGINEERING

1. **General Chemistry.** Entrance Chemistry, if offered, will not be accepted as the equivalent of this course.

Two lecture-demonstrations, one recitation, and one laboratory period, covering the fundamental principles of the science, the chemistry of the non-metals, and metals and the elements of qualitative chemical analysis.

Freshman; throughout the year; 3 credits.

2. **Qualitative Analysis.** The laboratory work will be varied to some extent according to the course pursued and will include analyses of alloys, rocks, minerals, slags, mattes, and other compounds or mixtures. One lecture or recitation and three laboratory periods per week.

Sophomore; 2nd semester; 3 credits.

3. **Quantitative Analysis.** An introductory course consisting of one lecture and three laboratory periods per week devoted to volumetric and gravimetric determinations, including practice in the calibration of flasks and burettes, acidimetry and alkalimetry, chlorimetry, and the analysis of simple compounds and ores.

Sophomore; 2nd semester; 3 credits.

4. **Organic Chemistry.** Two lectures and one recitation on the general principles and theories of organic chemistry and the methods of preparation and characteristic reactions of organic compounds with a corresponding laboratory course of three periods per week. A limited amount of work along special lines or organic chemistry may be elected.

Sophomore; throughout the year; 5 credits.

Examinations

Examinations are held semi-annually at the end of each semester. The work done during the semester, as well as the examinations, is considered in the grading of students. The results of the examinations are expressed on the basis of 100.

70 is required for passing; 60-70 indicates a condition; below 60 shows failure. Regularity of attendance at lectures and laboratory, and faithfulness in the performance of daily work are of as much weight in determining the standing of students in their classes as are the examinations.

Conditions.—Conditioned students must remove such conditions at the examinations given for that purpose during the following semester. Failing in this the student is obliged to discontinue the subject in which he is conditioned and to repeat it during the next semester.

For a special examination of this kind a fee of \$2.00 is charged.

